

1 $\frac{1}{2}$ years of IASI and AIRS Radiometric Comparisons using Double Differences

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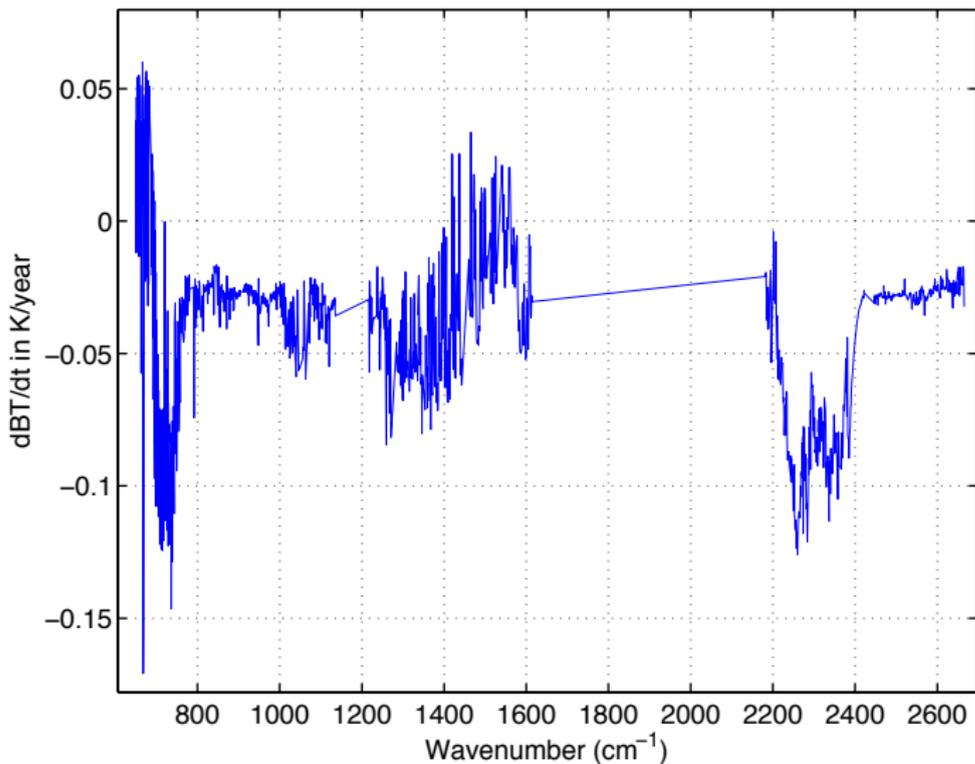
- AIRS/IASI/CrIS promise to give us a 20+ year hyperspectral time-series of climate
- How well can we tie together the AIRS and IASI records? (AIRS won't be around for CLARREO.)
- Highlights RTA performance issues
- Preparation for quick CrIS Cal/Val

- Retrievals do not account for all components of the (changing) radiances (clouds, dust, some minor gases, esp. CO₂).
- Will cloud-clearing yield and accuracy change as clouds (maybe) change? Very unclear if AIRS V5 retrievals are following climate trends.
- May need to eventually put AIRS/IASI/CrIS sensors on same footing (SRF) so can use a common RTA.
- Recent progress: UMBC using fitting $\frac{dR(\nu)}{dt}$ *directly* for minor gas rates (and T , Q profiles. Measuring dB(T)'s on order of $<0.01\text{K/year}$ (<1 ppm CO₂/year).
- Difficult to prove 0.01K/year stability. *If* AIRS and IASI yearly trends agree to this level, strongly suggests climate-level stability. **This is Part 2 of this talk.**
- But, we also need to connect these two sensors radiometrically, hopefully at the 0.01K level. **This is harder, and is Part 1 of this talk.**

Example of a Climate Signal: CO₂ Forcing

Avg 6-year BT Rates Spectra

IASI/AIRS

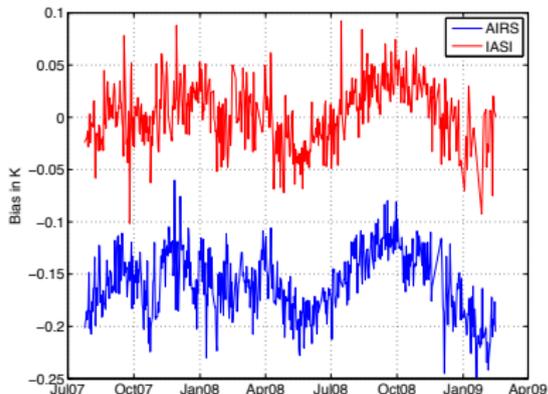
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Graph shows 712 cm^{-1} channel biases, raw spectra

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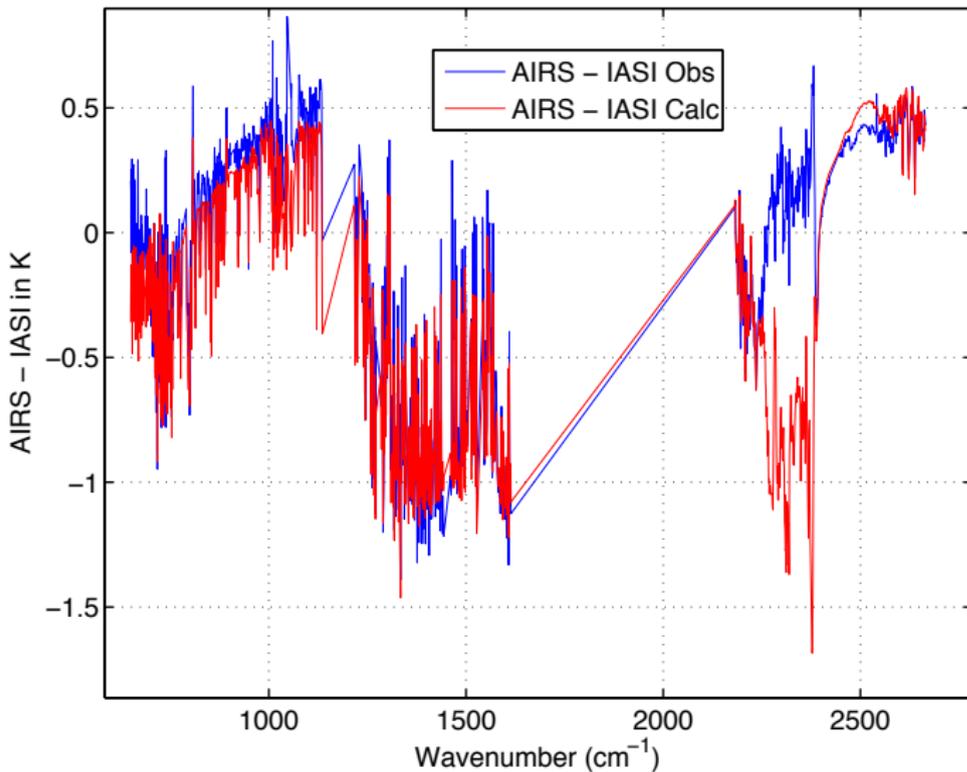
- Clear, ocean tropical scenes, mostly picked with a uniformity filter
- AIRS scenes from the GSFC DAAC AIRS ACDS (AIRS Climate or Calibration Data Set).
- IASI scenes selected using a similar algorithm run off of the IASI LIC data at UMBC.
- Mostly will just show means taken over 1 1/2 years.



Whoops, something wrong with IASI RTA in Strat?

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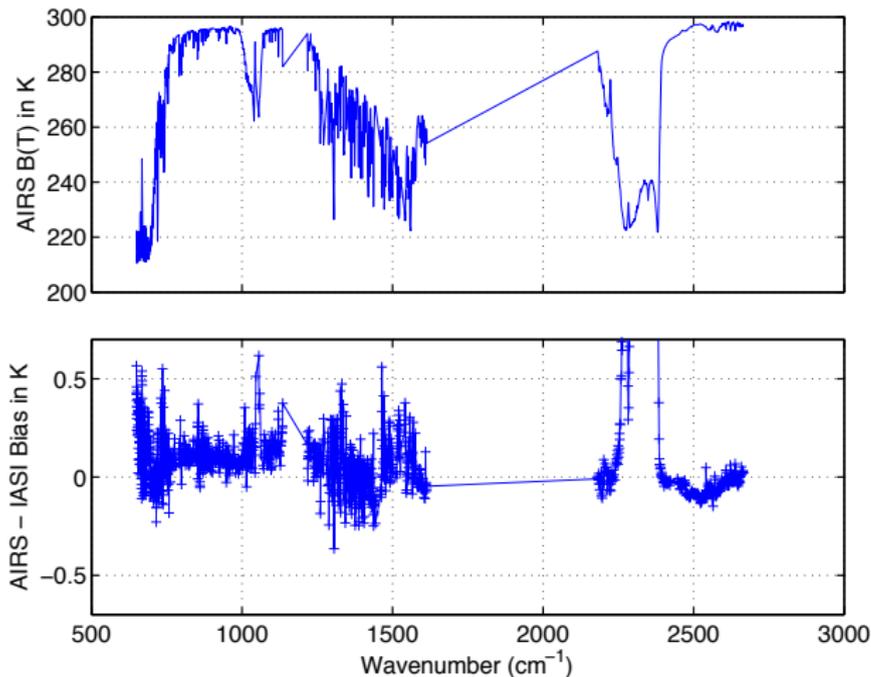
Unfiltered Observations using Double Differences:

$$DD = (\text{obs} - \text{cal}(\text{ECMWF}))_{\text{AIRS}} - (\text{obs} - \text{cal}(\text{ECMWF}))_{\text{IASI}}$$

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Important: To form the DD, the AIRS bias is convolved with the IASI SRF and vice-versa.

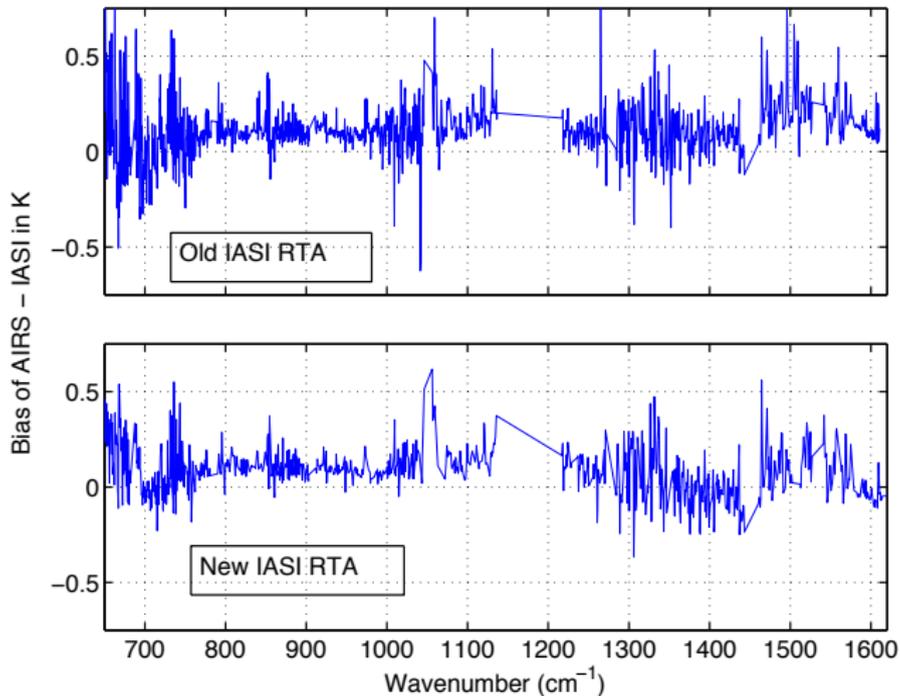


Corrected a FFT sampling procedure

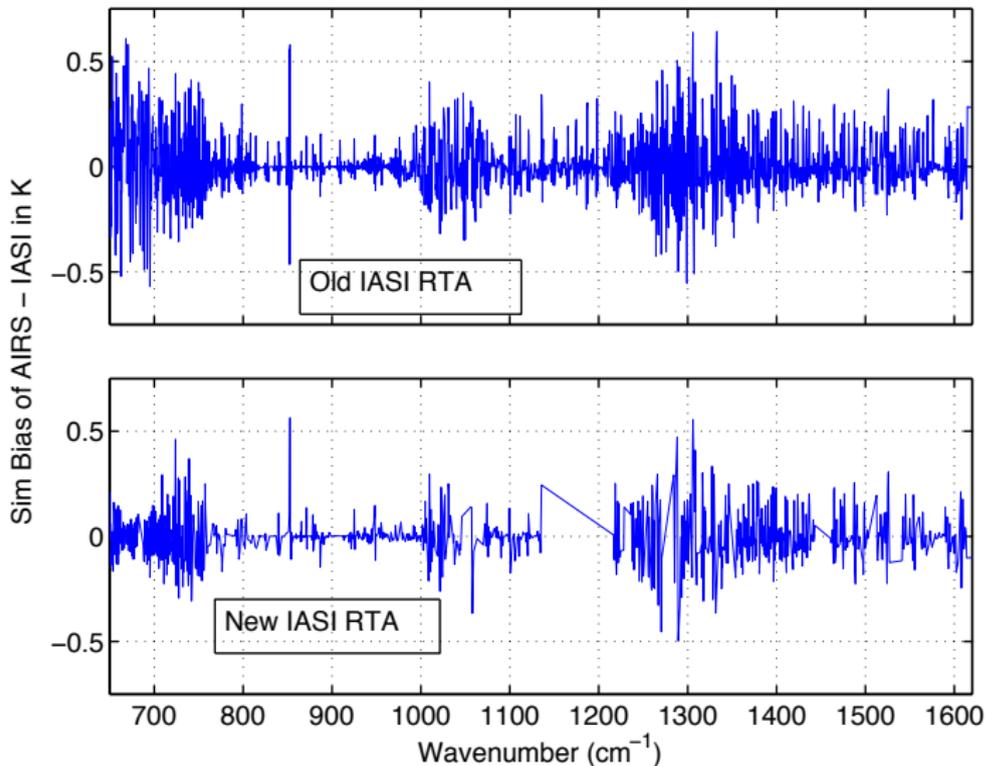
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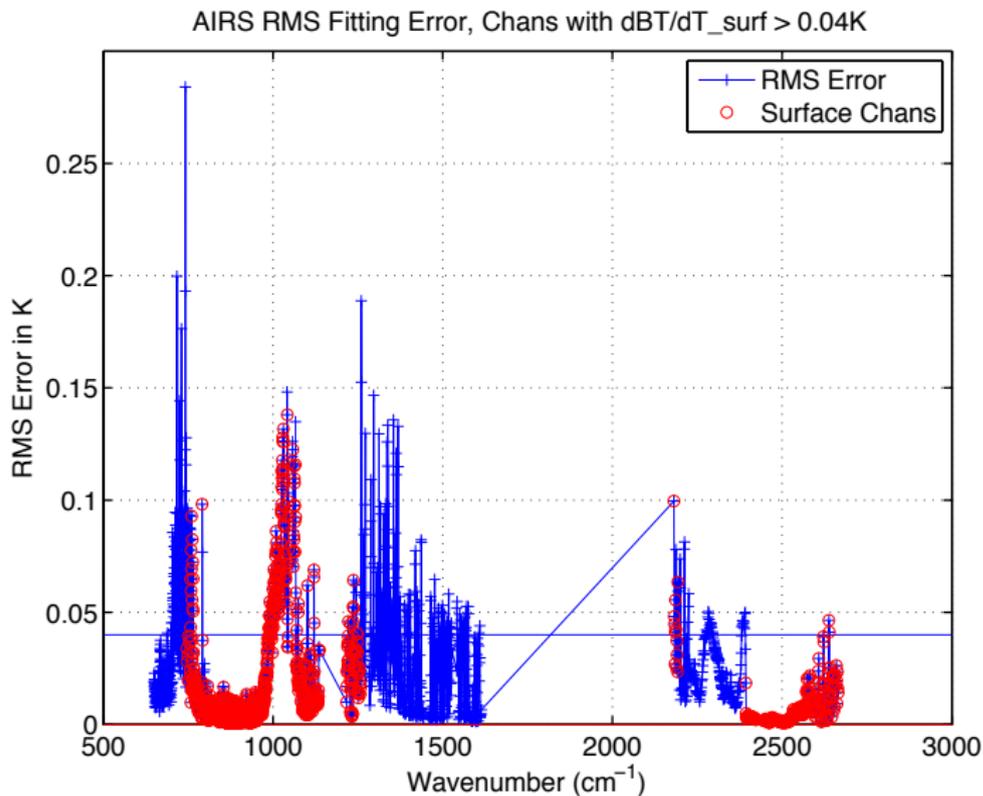
BUT, still lots of structure in the DD's.



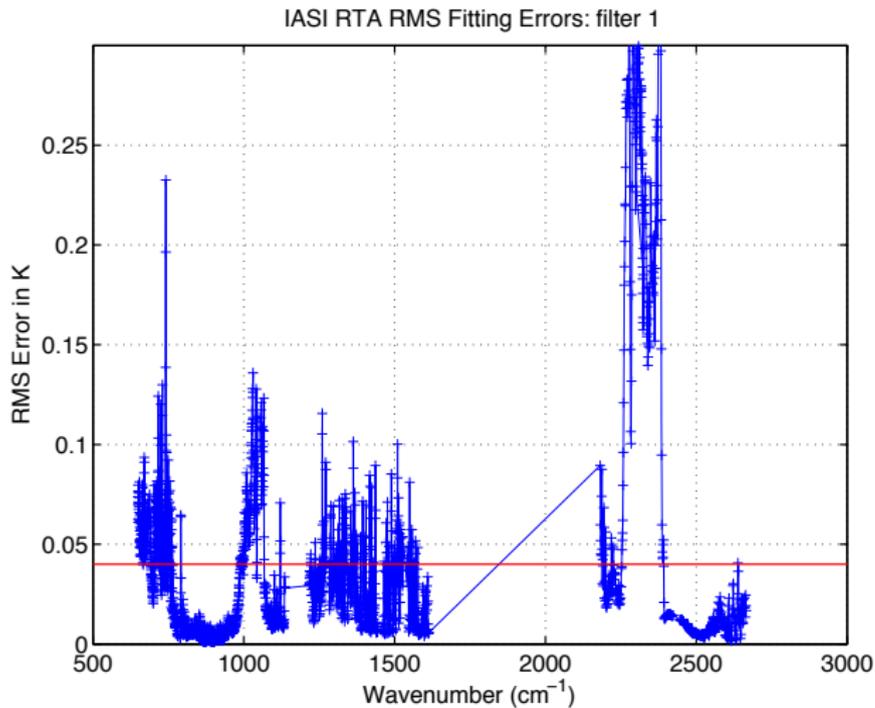
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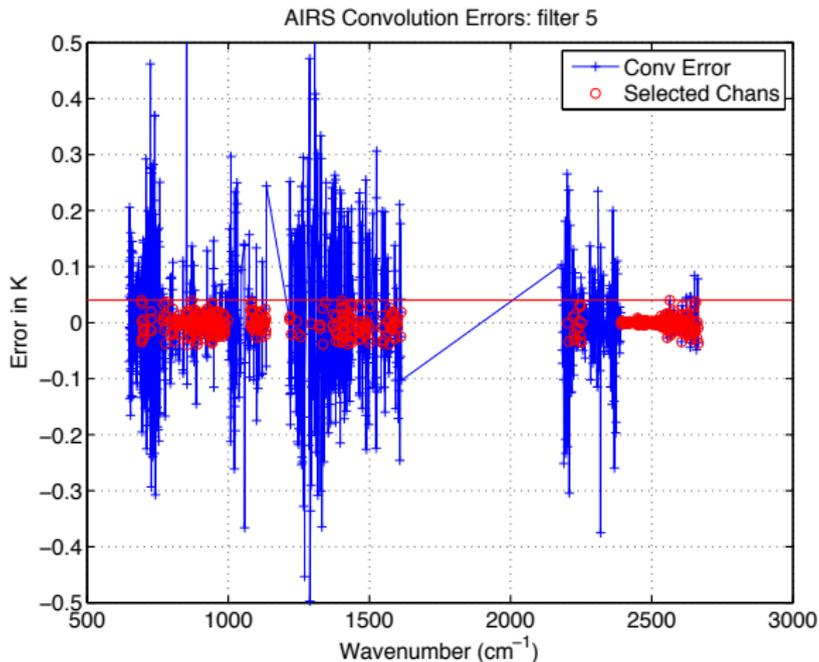
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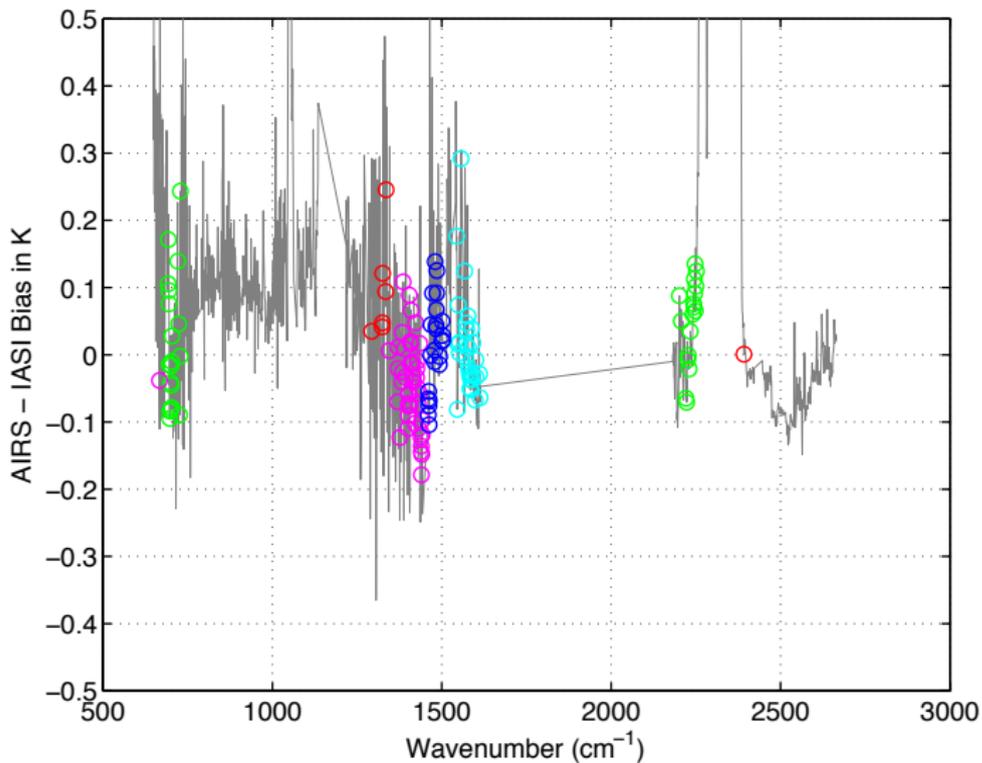
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This simulation used monochromatic radiances, no fast model. Selected channels have passed the previous filters, except the surface filter.



Colors are AIRS Arrays

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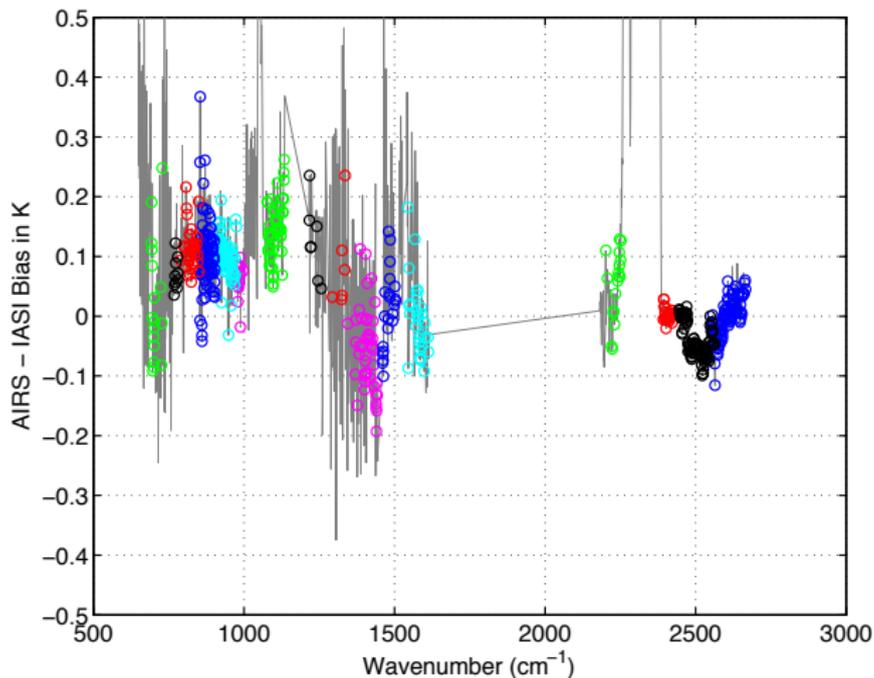
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Mean = 0.02 K

Std = 0.11 K

Freq	Numchans	Bias	Std
2392.07	1	0.00	0
2234.81	17	0.05	0.06
1409.76	43	-0.04	0.06
1577.52	30	0.01	0.08
1479.66	23	0.01	0.07
1323.03	6	0.10	0.07
705.41	19	0.02	0.10
666.51	1	-0.04	0

ECMWF SST after Oct. 2008 contains diurnal term so now we include surface channels



Stats including Surface Channels, Post Oct.
2008

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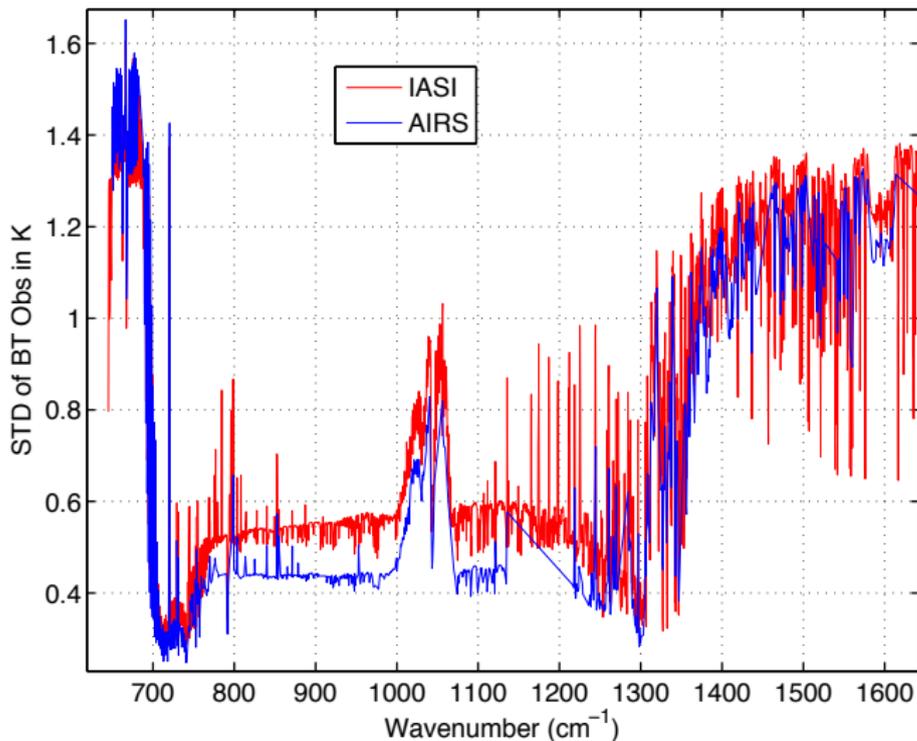
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Mean = 0.04 K

Std = 0.05 K

Freq	Numchans	Bias	Std
2604.68	90	-0.00	0.03
2407.62	30	0.00	0.01
2502.83	103	-0.04	0.03
2234.81	17	0.05	0.06
1409.76	43	-0.06	0.07
1578.24	29	-0.01	0.06
1479.98	22	0.01	0.06
1323.03	6	0.09	0.07
1232.03	7	0.13	0.06
1106.02	49	0.14	0.05
985.45	13	0.06	0.03
937.24	77	0.10	0.03
877.68	85	0.10	0.06
825.50	36	0.11	0.03
774.81	10	0.07	0.03
705.00	17	0.02	0.10

IASI/AIRS

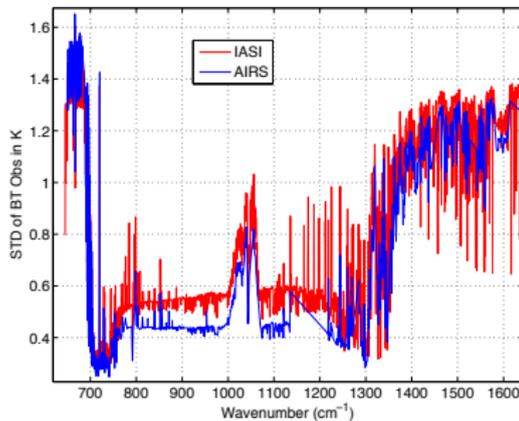
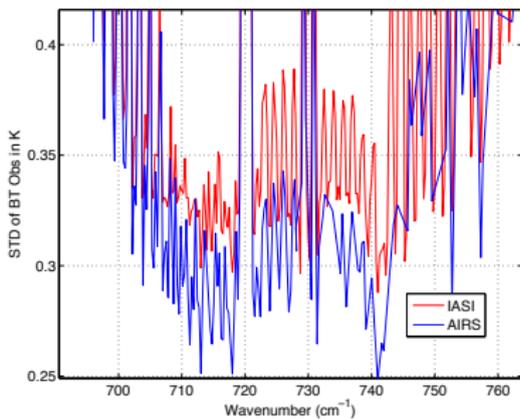
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Channels for Stability Analysis

Left: Zoom of Std of BTObs, Right: Std. Dev. of Bias

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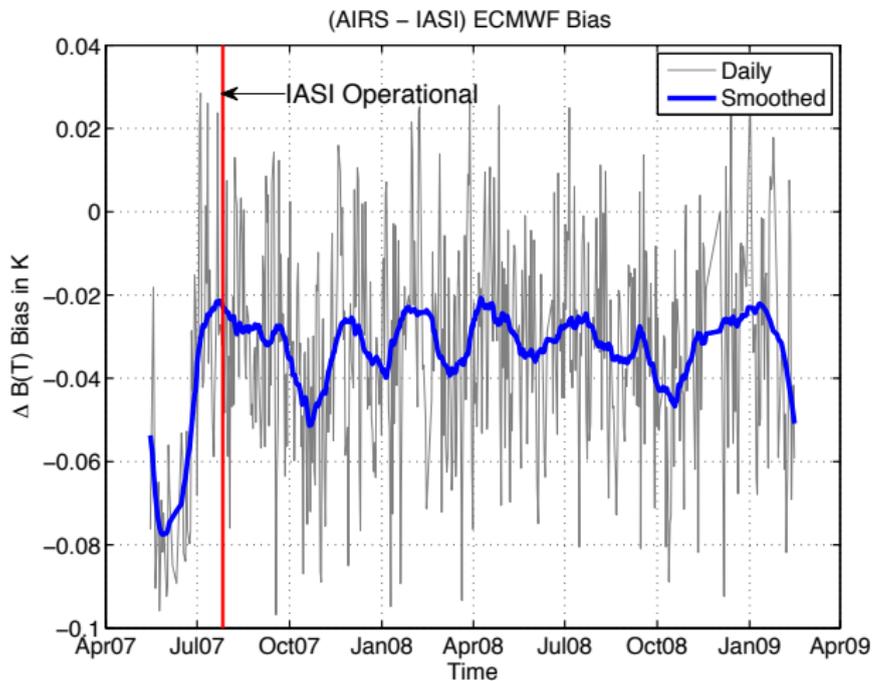
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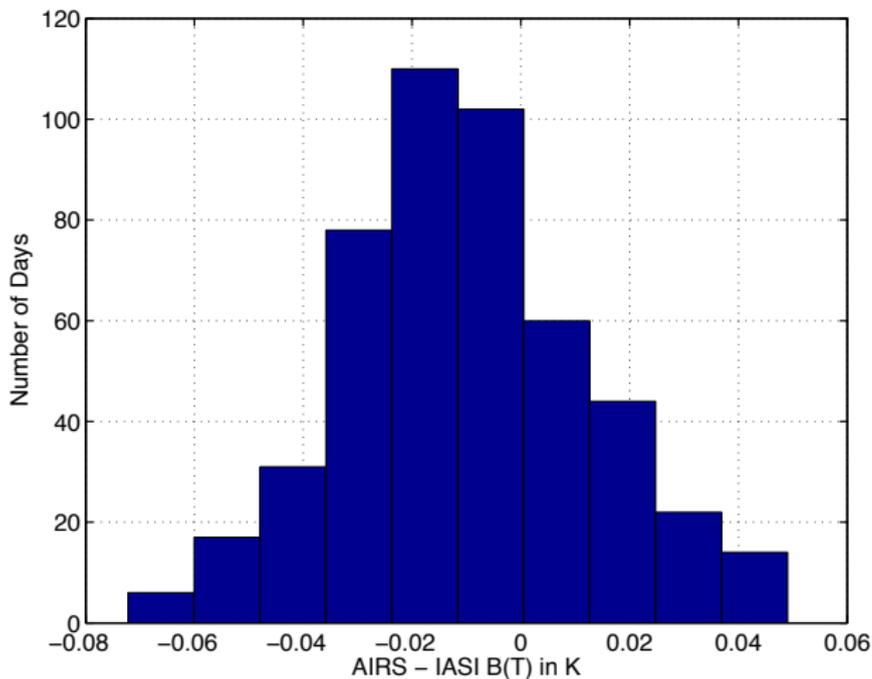
AIRS versus IASI Stability

 $-0.0019\text{K/year} \pm 0.008\text{K/year}$ (corrected for lag-1 correlation of 0.45)

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- A new cross-convolution approach: interpolation of AIRS for IASI SRF convolution
- Improve IASI RTA at high altitudes
- Climate quality SST for simulated radiances?
- Frequency calibration